Exercise walk-through

The Geometric Distribution ▪ 4.12

eXercise

You must be able to

- describe a **geometric** 几何 random variable as the number of trials until the first success
- use $P(\text{first success on trial } x) = (1-p)^{x-1}\,p$
- find the mean, $\dfrac{1}{p}$

Method — The geometric setting

Like a binomial, but instead of a fixed number of trials, a **geometric** random variable counts how many **trials until the first success** (independent trials, constant p).

Method — Probability and mean

$$P(X = x) = (1 - p)^{x-1}\, p, \qquad \mu_X = \frac{1}{p}.$$

With $p = 0.2$, the expected number of trials is $\dfrac{1}{0.2} = 5$.

Practice 2.1 ▪ 1 mark

State what a geometric random variable counts.

Solution 2.1

Method: The geometric setting

Worked steps

the number of trials until the first success B1.

Practice 2.2 ▪ 2 marks

For $p = 0.25$, find the mean number of trials to the first success.

Solution 2.2

Method: The geometric setting

Worked steps

$$\mu_X = \frac{1}{0.25} = 4 \quad \text{M1 A1}.$$

Practice 2.3 ▪ 1 mark

Write $P(\text{first success on trial } 1)$ in terms of p.

Solution 2.3

Method: The geometric setting

Worked steps

$P(X = 1) = p$ B1.

Exam-style 3.1 ▪ 1 mark

A geometric random variable counts the

A number of successes in n trials

B number of trials until the first success

C total number of trials

D number of failures only

Solution 3.1

Method: The geometric setting

A number of successes in n trials

B number of trials until the first success ✓

C total number of trials

D number of failures only

Worked steps

B.

Exam-style 3.2 ▪ 1 mark

The mean of a geometric distribution is

A p

B $\frac{1}{p}$

C np

D $\sqrt{p}$

Solution 3.2

A p

B $\frac{1}{p}$ ✓

C np

D $\sqrt{p}$

Worked steps

B.

Exam-style 3.3 ▪ 2 marks

A game gives $P(\text{win}) = 0.1$ on each try.
(a) Find the expected number of tries until the first win.
(b) Name the distribution.

Solution 3.3

Method: The geometric setting

Worked steps

(a) $\dfrac{1}{0.1} = 10$ M1 A1. (b) geometric B1.